**FINAL**



# OPERATION & MAINTENANCE MANUAL

# SOURCE CONTROL & VACUUM-ENHANCED DNAPL RECOVERY SYSTEM

*Prepared for*
Detrex Corporation
1100 State Road
Ashtabula, OH 44004

March 2004

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**URS**

March 12, 2004

Ms. Terese VanDonsel
United States Environmental Protection Agency
Office of Superfund, Region 5
SR-6J
77 West Jackson
Chicago, IL 60604-3590

Subject: Transmittal of Operations and Maintenance Plan
Source Control and Vacuum-Enhanced DNAPL Recovery System
Text Only
Detrex Corporation Facility
Ashtabula, Ohio

Dear Ms. VanDonsel:

On behalf of Detrex Corporation, URS Corporation (URS) has prepared an Operations and Maintenance Plan for the source control and vacuum-enhanced Pilot DNAPL recovery system, currently operating at the Detrex Facility. A copy of the table of contents and text is attached for your review. Detrex is currently reviewing final drawings and cut sheets to be included in the Final document.

If you have any questions regarding this submittal, please call.

Sincerely,

***URS Greiner Woodward Clyde***

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Detrex Corporation (Detrex) operates a facility at 1100 North State Road in Ashtabula, Ohio. This Operation & Maintenance Manual has been developed to assist personnel with groundwater and dense non-aqueous phase liquid (DNAPL) recovery systems located on northeast portion of the property where soil and groundwater have been impacted by chlorinated, volatile organic compounds (VOCs; 1,1,2-trichloroethane, 1,2-dichloroethene, tetrachloroethene and trichloroethene) and semi-volatile organic compounds (SVOCs; hexachlorobenzene, hexachlorobutadiene and hexachloroethane). The general Site location is presented on Figure 1. The groundwater recovery systems have been designed to prevent the migration of impacted groundwater and DNAPL from migrating off-site. The DNAPL recovery system has been designed to reduce the quantity of DNAPL on the site to the extent practical. This system has been installed to comply with the terms of the United States Environmental Protection Agency (U.S. EPA) *Unilateral Administrative Order* (UAO) and a *Scope of Work for Remedial Design and Remedial Action for the Detrex Source Area* (the UAO SOW), dated February 26, 1998, requiring that Detrex develop plans and specifications for remedial measures at the facility.

The two systems located at the site operate independent of each other. The down gradient slurry wall and collection trench were completed and began operation in March 2001. The pilot DNAPL recovery system was installed during the summer of 2002 and initiated operation in November 2002.

## 2.1 SYSTEM DESCRIPTION

Remedial Actions consist of a downgradient vertical barrier wall (slurry wall) with a groundwater collection trench located upgradient of the wall, a DS Tributary interceptor trench and a DNAPL recovery system.

Groundwater from the DS interceptor trench and the groundwater collection trench is collected passively in the groundwater collection trench and pumped from a stormwater collection sump to the Detrex storm water treatment system.

The main components of the pilot-scale vacuum-enhanced DNAPL recovery system consists of 12, 2-inch recovery wells, a vapor extraction blower, two air diaphragm pumps each located at the surface in a separate pump house, a DNAPL/water/solids separation tank, a DNAPL holding tank, three vapor-phase granular activated carbon vessels and the Detrex compressed air system. Each of the pump houses is equipped with an air diaphragm pump and manifold assembly. When the pumps are operating the SVE system is temporarily shut down. The air diaphragm pumps are powered by the Detrex air supply system via an air supply line. Each air diaphragm pump operates one well at a time. Wells are cycled utilizing an air actuated solenoid valve located in the manifold within the pump houses. The wells may also be operated manually if desired. To increase lift and enhance recovery the entire SVE piping system is temporarily pressurized when the air diaphragm pumps are operating. DNAPL and water from the wells is pumped into a 500-gallon settling tank. DNAPL is decanted into a drum until its disposed of by Detrex.

The rate of DNAPL recovery to the wells is enhanced using the soil vapor extraction (SVE) system. This system induces a vacuum on the unsaturated portion of the screened interval at each recovery well location. A regenerative SVE blower located inside the equipment building provides the required suction. A 1.5-inch diameter, stainless-steel suction line is connected to each wellhead; this line also provides secondary containment for the groundwater tubing. The vacuum lines are manifolded at Pump House 1 and Pump House 2. The air is drawn through a 20-gallon air-water separator (AWS) and treated via two, 1,800 pound vapor GAC vessels. The treated vapor is then exhausted to the outside. The water collected by the AWS is transferred to the separation tank via a transfer pump. All collected groundwater flows from the separation tank into the Detrex storm water collection system.

The pilot-scale, vacuum-enhanced DNAPL recovery system was installed to remove readily recoverable DNAPL from the subsurface. The pilot-scale operation was initially proposed for a 1- to 2-year time period to optimize the design of the full-scale system. System modifications are currently being evaluated due to continuing problems of excess silt, collapsing wells and short circuiting of compressed air in wells.

## 2.2 SYSTEM COMPONENTS

A description of system components is provided in the following sections. Manufacturer's information (if applicable) on these components is provided in the appendices.

### 2.2.1 Vertical Barrier Wall /Groundwater Recovery Trench/ DS Interceptor Trench

The general layout of the slurry wall and the passive collection is presented on Figure 2. A vertical barrier wall (slurry wall) was constructed along the leading edge of the of the dissolved phase plume along the western border of the Detrex property. The barrier extended beneath the active railroad spur and onto the RMI Sodium Property to the north. A passive groundwater collection trench was installed immediately upgradient of the vertical wall. An interceptor trench was installed beneath the DS Interceptor to prevent the migration of groundwater to the DS Tributary. Groundwater collected in the DS interceptor trench was also routed to the groundwater collection trench. The groundwater collection trench and the DS Interceptor drain via gravity to a Stormwater pump station. Water processed from the pump station is treated by the Detrex stormwater treatment system prior discharge.

### 2.2.2 DNAPL Recovery Wells

The recovery wells (RW-1 through RW-12) are designed to recover soil vapor and DNAPL from the unconsolidated sediments. The well boreholes have been advanced up to two feet into the top of the clay till material. Total well depth varies from 23 to 30 feet below ground surface. The recovery wells are equipped with a 2-inch inside diameter (ID), Type 304 continuous wrap, and stainless steel screen in an 8-inch diameter borehole. The upper portion of each well is constructed of Type 304 stainless steel casing.

Fifteen feet of screen have been installed in each well. Each well has been retrofitted with an internal blank section of 1.25–inch high density polyethylene (HDBE) liner to blank off the upper portion of screen to reduce the potential for the short circuiting of air to the surface. Approximately, one to two feet of screen are currently exposed. The well screens have 0.020-inch slots. The area below and within the annular space around the well screen is filled with a sand pack that extends one-half to one foot above the screen. Neat cement grout has been installed above the sandpack. The sandpack extends approximately one foot above the screen. Boring logs and well completion diagrams are presented in Appendix A. Each well is equipped with a 1-inch stainless steel drop tube that extends to the bottom of each well. Several holes were machined into the sides of the drop tube throughout the bottom 3 to 4 feet DNAPL is recovered through the holes in the drop tube.

### 2.2.3 Soil Vapor Extraction System

The SVE system is designed to provide a maximum of 200 cubic feet per minute (cfm) of vacuum to the twelve recovery wells in the network. The vacuum for the system is generated using a 200 cfm maximum flow (0-inches Hg) EG&G Rotron regenerative blower that will operate at a maximum of 30 scfm at a vacuum of 5.5 inches of Hg.

From the manifold, the SVE system influent is routed to a silencer followed by a 20-gallon capacity stainless steel AWS to remove free liquid. A 3-inch ball-float check valve prevents water in the AWS from entering the blower. An air diaphragm pump is operated manually to transfer collected water from the AWS to the 500 gallon settling tank. The vapor stream is then treated through two 1,800 pound vapor-phase granulated activated carbon (GAC) vessels, which are connected in series. Treated exhaust is then discharged to the atmosphere. SVE Blower Manufacturer's information is presented in Appendix C.

Specific SVE component information is summarized in the following paragraphs.

### *Air-Water Separator (AWS)*

Manufacturer: Detrex

Flow Rate: 150 cfm at 40 inches of water

Inlet/Outlet: 2 ½" Inlet / 1 ¼" Drain Valve

Size: 20 gallons

### *Regenerative Blower*

Manufacturer: EG&G

Model: CP656BR72M

Power Rating: 3 HP

Flow Rate: 212 scfm at 70 inches of Water (maximum)

### *Inline Air Filter*

Manufacturer: Rotron

Part Number: 515255

Replacement Element (3 micron) Part Number: 516435

Operating Flow Rate: 290 cfm

Inlet/Outlet: 2" American Standard Taper pipe threads, female (FNPT)

### *Flowmeter*

Manufacturer: Rotor Flex Flow Sensor

Model: +GF+515/2536

Inlet/Outlet: 1/2" NPT conduit connection

***Vacuum/Pressure Relief Valve***

Manufacturer: Rotron

Model: 523230

Inlet/Outlet: 2" American Standard Taper pipe threads, male (MNPT)

Vacuum Range: -35 to -90 inche of Water

### 2.2.4 Air Diaphragm Pumps

Two air-operated, 0.75-inch Yamada air diaphragm pumps are used to pump DNAPL and water from the recovery wells. A 0.5-inch Yamada air diaphragm pump is used to pump water from the AWS tank to the 500-gallon settling tank. Manufacturer's information for the pumps is presented in Appendix B. Recovery well pump operation is controlled manually or automatically by the Aquila Automation process logic control (PLC) system. The pumps are located in the pump houses and pump one of six wells at a time. To assist in the lift of the DNAPL the SVE piping is pressurized during the pumping operations. Air supply for the pump and the pressurized system is supplied by the Detrex air supply system. The transfer pump is only operated manually.

***Air Diaphragm Pumps***

Manufacturer: Yamada

Model: MDP-20BPS

Flow Rate: 26.4 max gpm

Type: 0.75–inch HDPE, air-operated, diaphragm pump

*AWS Transfer Pump* : 0.5-inch HDPE air-operated, diaphragm pump

### 2.2.5 Air Compressor

All compressed air is currently supplied by the Detrex Air Supply System. The system is operated and maintained by Detrex under an existing operations and maintenance plan.

### 2.2.6 Flow Totalizer

A horizontal turbine meter (flow totalizer) is located downstream from the 500-gallon settling tank for quantification of the total flow through the system. The totalizer is equipped with an electronic meter reading system and can provide a reasonable indication of total flow.

### 2.2.7 Level Sensors for Separation Tank and Air-Water Separator

The 500-gallon settling tank is equipped with a high level sensor. The high level sensor shuts the system down when it is activated during a high level occurrence.

The DNAPL recovery system is designed to operate unattended. However, due to high silt loading, from the recovery wells, the sensors foul readily and are not reliable. The system has been operated manually during normal working hours.

## 3.1 Slurry Wall/ Groundwater Recovery Trench/ DS Interceptor

### *Slurry Wall*

The vertical barrier wall is a passive remedial action that requires no operation or maintenance program.

### *Groundwater Recovery Trench*

The groundwater collection trench is a passive remedial action that will require minimal maintenance. Inspection of the flow from the trench at the pump station and the associated cleanouts will be conducted on a quarterly basis. The inspection will identify any damage to the cleanouts or if the flow to the pump station is consistent, indicating no trench obstruction. If standing water is noted in the cleanouts, Detrex personnel will clean out the debris or a cleaning contractor will be retained.

The groundwater collected from the trench will be transferred to the existing wastewater treatment system. Operation and maintenance on the treatment system is described in the existing plan for the treatment system.

### *DS Interceptor Trench*

The interceptor trench beneath the DS Tributary is a passive remedial action that will require minimal maintenance. Inspection of the groundwater discharge from the trench at the pump station and the associated cleanouts will be conducted on a quarterly basis. The inspection will identify any damage to the cleanouts or if the flow from the trench is consistent, indicating no collection trench obstruction. If standing water is noted in the cleanouts, Detrex personnel will clean out the debris or a cleaning contractor will be retained.

The groundwater collected from the trench will be transferred to the existing wastewater treatment system. Operation and maintenance for the treatment system are described in the existing plan for the treatment system.

The wastewater is discharged after treatment to an NPDES-permitted discharge point. The existing NPDES monitoring program addresses the groundwater constituents identified at the Detrex facility.

## 3.2 DNAPL Recovery System

Standard Operating Procedures (SOPs) for start up and shut down procedures for the DNAPL Recovery system is included below. Process and Instrumentation diagram (P&ID) is presented on Figure 3.

### 3.2.1 Startup/Setup Procedures

1. Open valve T707.3 (air surge tank drain) at T707 and drain all liquid from T707 to a designated container, then close valve T707.3.
2. Close valves A12a.0.8 (PH 1 distribution box drain) and P709.5 (PH 1 recovery pump drain) in A12a (pumphouse #1), then open valves A12a.0.7 (air valve to PH 1 distribution box), P709.2 (air valve at PH 1 recovery pump), P709.3 (P709 intake) and P709.4 (P709 discharge).
3. Make sure valves A12b.0.8 (PH 2 distribution box drain) and P710.5 (PH 2 recovery pump drain) are closed in A12b (pumphouse #2) then assure that valves A12b.0.7 (air valve to PH 2 distribution box), P710.2 (air valve at PH 2 recovery pump) P710.3 (P710 intake), and P710.4 (P710 discharge) are open.
4. Open valve T707.11 (air valve from air surge tank in the equipment building) and close valves P709.6 (wells valve from PH 1 in the equipment building) and P710.6 (wells valve from PH2 in the equipment building). Turn the main power switch at A12.1 (PLC control panel) to the on position.
5. Turn P708 (wells vacuum pump) switch at A12.1 to the on position, push system start switch which automatically opens valves P708.3 (solenoid valve on blower manifold for vacuum at PH 1 distribution box) and P708.4 (solenoid valve on blower manifold for vacuum to PH 2 distribution box) open. Check the valves to make sure they opened.
6. **Note:** T701 must settle undisturbed for a minimum of 12 hours before transferring water, DNAPL, or solids from system. This is required to minimize potential of getting any DNAPL in the water discharge.

### 3.2.2 Transfer T701 Contents

1. Record the T702 (DNAPL holding tank) level from A12.3, open valves P713.1 (air valve at the water transfer pump), P713.2 (water transfer pump intake valve), and P713.3 (water transfer pump discharge valve) and P713.5 (air valve manifold to P713). Turn P713 switch to the on position and push the start switch at the control panel and transfer the water layer in T701 to T004. After water transfer has been completed, turn P713 switch to the off position and close valves P713.2, P713.3 and P713.5.
2. Open valves P712.1 (air valve to the DNAPL transfer pump), P712.2 (DNAPL transfer pump intake), P712.3 (DNAPL transfer pump discharge), and F713.2 (solids filter discharge). Turn the P712 switch to the on position, push the start switch and transfer the DNAPL layer from T701 to T702. After the DNAPL transfer has been completed, turn the P712 switch to the off position and close valves P712.2, P712.3, and F713.2.

3. Open valve P714.1 (solids transfer pump intake). Turn the P714 switch to the on position and push the start button which pump the solids layer from T701 to the DNAPL decant drum. After the solids layer transfer has been completed, turn the P714 switch to the off position and close valve P714.1
4. TRANSFER INTO T701
5. Close valve T701.4 (wells sample valve in A12). Check the T703 tank level on the PLC maintenance screen. If a level is indicated, open T701.1 (at vacuum system moisture separator), P711.1 (air valve at moisture separator pump), and P711.2 (air line valve to P711). Turn P711 switch at A12.1 to the on position and pump the liquid from T703 to T701. After liquid transfer has been completed, turn P711 switch to the off position and close valves
6. Note: Check the DNAPL decant drum level and change the drum as necessary. Move the full drum to the area designated by the lab and label per lab instructions.
7. Close valves P712.4 (DNAPL transfer pump drain), P713.4 (water transfer pump drain), P714.2 (solids transfer pump drain), F713.3 (solids filter discharge line drain) and T701.4 (wells sample valve in the equipment building. Check the DNAPL decant drum liquid level. If a level is indicated, open valves P715.1 (air valve at the DNAPL decant drum transfer pump), P715.2 (air valve at valve manifold), T701.1 (valve at T701 to DNAPL transfer pump), T701.2 (valve at T701 to the water transfer pump) and T701.3 (valve at T701). Turn the P715 switch at the control panel to the on position and pump the liquid from the DNAPL decant drum to T701. After the liquid layer transfer has been completed, turn the P715 switch to the off position.

### 3.2.3 PUMP WELLS

1. After P708 has run for at least two (2) hours, turn the P708 switch to the off position and assure valves P708.4 and P708.3 are closed on the blower manifold. Check the PLC wells screen for PH1 and PH2 and record the pumping time for each well on the DNAPL Recovery Wells Data Sheet.
2. Record the totalizer reading from A12.2 and open valve P709.6 (from PH1 in the equipment building). Turn the P709 switch to the on position at the control panel and push the start switch which pumps wells one (1) through six (6) to T701. Record pumping time for each well as indicated on the PLC wells information screen. After well # six (6) has completed pumping, turn the P709 switch to the off position and close valve P709.6.
3. Record the flow totalizer reading from A12.2 and open valve P710.6 (valve from PH2 tin the equipment building). Turn the P710 switch to the on position at the control panel and push the start switch which pumps wells seven (7) through twelve (12) to T701. Record the pumping time for each well as found on the PLC wells information screen. After all have completed pumping, turn the P710 switch to the off position and close valve P710.6. Record the flow totalizer reading from A12.2.

## 3.3 Maintenance Tasks

### 3.3.1 Slurry Wall/ Groundwater Recovery Trench/ DS Interceptor Trench

***Slurry Wall***

The vertical barrier wall is a passive remedial action that requires no operation or maintenance program.

***Groundwater Recovery Trench***

Inspection of the flow from the groundwater trench at the pump station and the associated cleanouts will be conducted on a quarterly basis. The inspection will identify any damage to the cleanouts or if the flow to the pump station is consistent, indicating no trench obstruction. If standing water is noted in the cleanouts, Detrex personnel will clean out the debris or a cleaning contractor will be retained.

***DS Interceptor Trench***

Inspection of the groundwater discharge from the trench at the pump station and the associated cleanouts will be conducted on a quarterly basis. The inspection will identify any damage to the cleanouts or if the flow from the trench is consistent, indicating no collection trench obstruction. If standing water is noted in the cleanouts, Detrex personnel will clean out the debris or a cleaning contractor will be retained.

The groundwater collected from the trench will be transferred from the pump station to the existing Detrex wastewater treatment system. Operation and maintenance for the treatment system and the pump station are described in the existing plan for the treatment system.

### 3.3.2 DNAPL Recovery System

Process and Instrumentation diagram (P&ID) is presented on Figure 3. Proper safety procedures must be used when servicing the DNAPL recovery system. Safety Procedures are presented in the Site-Specific Health Plan.

### 3.3.3 Air Diaphragm Pumps and Controllers

Appendix B contains maintenance information for the air diaphragm pumps and the air powered solenoids. The air diaphragm pumps, which should require little maintenance, can be readily inspected. The pumps should be removed as needed and inspected for wear or damage.

### 3.3.4 Soil Vapor Extraction System

Appendix C contains maintenance information on the SVE system components, including the AWS, SVE blower, air filter, and vacuum/pressure relief valve.

***AWS***

The interior of the AWS should be inspected as needed for corrosion and sediment build up and cleaned as necessary. During each inspection the 3-inch ball-check should be inspected and cleaned, if necessary.

***SVE Blower***

Under normal operation, the SVE blower requires little maintenance. Bearing service will be required approximately every 20,000 hours of operation (every 2.3 years, assuming continuous operation). Hour meter HM-1 on the control panel tracks the hours of operation of the SVE blower. Rotron, the manufacturer, recommends that bearing servicing be performed by factory personnel.

***Air Particulate Filter***

The air particulate filter located between AWS and SVE blower should be replaced as needed based on a visual inspection.

***Air Flow Meter***

The air flow meter has been designed to require minimal maintenance. Cleaning of the meter should be performed as needed.

***Vacuum Relief Valve***

The vacuum relief valve has been designed to require minimal maintenance. During normal operation, the maintenance required includes cleaning the valve. The vacuum relief valve should be cleaned at least annually or as needed using a Rotron-approved solvent. Disassembly of the valve for cleaning is usually not required. A pin or small wire may be used to clean the small hole through the center of the valve piston.

### 3.3.5 500 Gallon Settling Tank

Appendix D presents manufacturer's information on the 500-gallon settling tank. The settling tank should be cleaned on an as-needed basis. Any silt that is acquired from this cleanout will be put into a plastic or lined drum and properly labeled for disposal. Free DNAPL will be collected and either pumped to storage tank and/or collected in a plastic or lined drum and properly labeled for disposal. All water that is collected from this clean out will be sent to the water treatment system prior to discharge.

### 3.3.6 Flow Totalizer

Appendix E contains maintenance information for the flow totalizer.

### 3.3.7 Level Sensor for 500-Gallon Settling Tank

Appendix F contains maintenance information for the 500-gallon settling tank high level sensors. Fouling should be removed from switch located in the settling tank on an as-needed basis to maintain proper function. The SOP for sensor cleaning is as follows:

4. Shut off the treatment system.
5. Remove the bolts from the level sensor mount and lift out the sensor assembly.
6. Rinse off bulk of iron and silt deposits from sensors with water and a brush.
7. Soak sensor assembly in Iron-Out® solution (if necessary).
8. Reinstall sensor assembly.
9. Restart or reset system following SOP for start up.

Level switch alarm conditions will be checked monthly (or as needed) as follows:

1. Manually trip the high level switch in the settling tank to verify function.
2. Reset remedial system.

### 3.3.8 Miscellaneous System Components

The various system components, including the system heaters, heat tape, ventilation fans, control valves and manifold tubing, should be inspected, cleaned or replaced on an as-needed basis.

## 3.4 Prescribed Treatment or Operating Conditions

### 3.4.1 Air Diaphragm Pumps and Controllers

Appendix B contains operational information for the Yamada air diaphragm pumps and air actuated controllers. The pumps will run for a prescribed period of time as determined by field testing. The system has the capability of full automation. However, until all operational parameters have been assessed the system will be operated manually during normal working hours. System automation information (PLC) is presented in Appendix F.

### 3.4.2 Soil Vapor Extraction System

The SVE system blower is designed to operate at approximately 100 cfm at a vacuum of 4-inches of Mercury.

The SVE blower may be damaged if the ambient temperature exceeds 110 °F. Blower exhaust temperature should never exceed 230 °F. The blower may be cooled by opening the bleed air valve on the SVE system skid on the vacuum side of the blower.

An air filter is located immediately downstream from the AWS to prevent larger particles from reaching the SVE blower. The air filter should be replaced at least semiannually or as needed.

### 3.4.3 Air-Water Separator

The AWS is equipped with a 3-inch ball float check-valve designed to prevent water in the AWS from entering the blower. The check valve will be inspected on an as needed basis when the AWS interior is inspected and cleaned. Very little accumulation of water flow is expected from the AWS to the settling tank.

### 3.4.4 Flow Totalizer

Appendix E contains operational information for the flow totalizer. The totalizer will measure cold (33 to 100 °F) water flow in one direction only.

### 3.4.5 High Level Sensor, Settling Tank (/These are no longer in service.)

Appendix F contains operational information for the settling tank and the high level sensor

## 3.5 Operation & Maintenance Schedule

The system will operate during normal working hours. The schedule presented in Table 1 identifies the nature and frequency of anticipated maintenance tasks.

**Table 1 – Summary of Maintenance Requirements**

| Item | Description | Frequency |
|---|---|---|
| Groundwater collection and DS tributary interceptor trenches | Inspect pump station for flow and inspect cleanouts for damage. | Quarterly |
| Air Diaphragm pump inspection and repair | Inspect & repair as necessary. | Annually or as needed |
| AWS & ball-Float Check-Valve inspection/cleaning | Inspect interior and clean as necessary. | Annually |
| Bearing service on SVE blower | Bearing service; | Every 20,000 hours |
| Inline air filter | Replace filter between AWS and SVE blower. | As needed based on visual inspection |
| Air flowmeter | Remove meter and clean if it become plugged. | Annually or as needed |
| Vacuum relief valve | Clean valve if it becomes clogged. | Annually or as needed |
| AWS transfer pump repair | Regular visual inspection, repair as needed | As needed |
| Settling tank cleaning | Clean deposits out of tank on an as-needed basis. | As needed |
| Flow totalizer calibration | To be performed as needed. | Every six months or as needed. |
| High Level switch cleaning | Switches located in separator and Settling tank. Remove fouling to maintain proper function. | As needed |
| High Level switch alarm conditions | The high-high switch in the Settling tank should be manually tripped to verify that they function. | Monthly |
| Groundwater manifold tubing, and site tubes | Clean or replace clear tubing on an as-needed basis to allow for inspection of flow and levels. | As needed |

## 4.1 Description & Analysis of Potential Operating Problems

### 4.1.1 Slurry Wall/ Groundwater Recovery Trench/ DS Interceptor Trench

***Slurry Wall***

No operating problems are foreseen for the vertical barrier wall. Problems with the construction of the vertical wall barrier are addressed in the contractor's contingency plan. The groundwater monitoring wells used to monitor the conditions around the barrier wall could become damaged at the surface or the screens become blocked (by silt) and unusable.

If the monitoring wells were to become unusable, repairs would be made to return the wells to service. If the wells could not be repaired, replacement may be required.

***Groundwater Recovery Trench***

The only problem that could affect the groundwater collection trench would be the trench collecting silts and fines and restricting the flow. The trench collection piping is equipped with cleanouts that will be used if the flow is significantly restricted.

***DS Interceptor Trench***

The same problems and remedies that would affect the groundwater trench stated above could affect the interceptor trench and would be addressed accordingly

### 4.1.2 Groundwater Recovery Wells

Performance of the groundwater recovery wells is, in part, a function of the local hydrogeologic conditions, which may vary seasonally and year to year. The frequency and duration of operation will increase at times of high groundwater levels and following precipitation or snowmelt events.

Reduced flow may be attributed to chemical incrustation, biofouling or damage to the air diaphragm pumps. Damage to the pumps may occur when a large quantity of particles, typically sand, continue to flow into the well from the sand pack or formation.

There has been severe problems occurred from excessive silt and crystals. The silt and crystals plug valves, pumps, lines, and collects in the bottom of the EQ tank.

### 4.1.3 Air Diaphragm Pumps

The cut sheets for the air diaphragm pumps and components (Appendix B) provide a relatively comprehensive guide to troubleshooting potential problems with the pumps. Reduced flow may be caused by buildup of silt or encrustation within the pump. Additionally, normal wear and tear will eventually pump output. Additionally, improper air supply requirements will also be evident in reduced flow.

### 4.1.4 Soil Vapor Extraction System

The cut sheets for the SVE system components (Appendix B) provide a relatively comprehensive guide to troubleshooting potential problems with the AWS, SVE blower, air filter, flowmeter and vacuum/pressure relief valve.

Buildup on the inlet and exhaust filters attached to the SVE blower may result in increased pressure drop, reduced air flow and hotter operation of the blower. This buildup can also cause vibration, failure of the motor to operate or reduced flow.

If debris enters the air flow meter, the meter can become plugged, resulting in failure of the meter to perform.

If debris enters the vacuum relief valve, the hole through the center of the valve piston may become clogged, and the valve will not function properly.

### 4.1.5 AWS and Settling Tank

The air-water separator tank is constructed of stainless steel construction or excessive corrosion will cause the drum to leak. Plastic may not be used due to excessive vacuum will render plastic containers useless.

The 500-gallon settling tank and site glass may become fouled or potentially clogged with silt, thus preventing the site glasses to show the proper level in the tank.

### 4.1.6 Flow Totalizer

The Operation and Maintenance Manual for the flow totalizer (Appendix E) provides a relatively comprehensive guide to troubleshooting potential problems with the totalizer.

### 4.1.7 Level Sensors for Settling

The Operation and Maintenance Manuals for the high level sensors and message center (Appendix E) provide a relatively comprehensive guide to troubleshooting potential problems with this equipment.

## 4.2 Means of Detecting Problems in The Operating Systems

### 4.2.1 Groundwater Recovery Wells, Pumps and Controllers

Detrex will assess the condition of the pumps and recovery wells based on the operating patterns including flow and groundwater levels in the vicinity of the recovery wells. If patterns indicate a reduced recovery of DNAPL in conjunction with increasing DNAPL levels in nearby monitoring wells, recovery well rehabilitation may be required.

Reduced flow may also be attributed to chemical incrustation, biofouling or damage to the recovery pumps.

The majority of problems that develop with air diaphragm pumps are mechanical and most of these problems may be identified with visual inspection the pump parts. Repair kits are available from the manufacturer for pump repair and maintenance.

### 4.2.2 Soil Vapor Extraction System

The Operation and Maintenance Manual for the SVE system (Appendix C) provides a relatively comprehensive guide to troubleshooting potential problems with the system. Problems with the SVE blower will most likely be either excessive noise or elevated temperature or vacuum readings. Unusual noises may indicate an electrical condition or a problem with the impeller adjustment or the bearings. Elevated temperature or vacuum may indicate that the blower is operating beyond its design range. This condition can potentially be addressed by bleeding air.

Low vacuum levels may indicate a problem with the blower or a leak in the system piping. If the blower meets its performance specifications while in a "deadhead" position, a leak in the piping is likely. The leaking pipe section can be isolated using the valves on the SVE manifold.

### 4.2.3 Air-Water Separator and Settling Tank

The AWS and the settling tank may periodically become fouled with silt. The material of construction of this piece of equipment is constructed of stainless steel to prevent corrosion leading to leakage.

### 4.2.4 Flow Totalizer

Flow totalizer malfunction can be attributed to failure of the register, meter interior or strainer, each of which can not be replaced without removal of the meter from the line.

### 4.2.5 Level Sensors for Settling Tank

When an alarm condition occurs, the specific alarm message will appear on the message center and will remain until the alarm condition is cleared or the reset button is pushed. Reset instructions are presented in the manufacturer's information for the PLC in Appendix F.

## 5.1 MONITORING TASKS

Monitoring will be performed to assess the effectiveness of the system. Monitoring data will also be used to demonstrate that the DNAPL plume is stable or reducing in aerial extent.

### 5.1.1 Slurry Wall/ Groundwater Recovery Trench/ DS Interceptor Trench

***Inspections***

The stormwater collection sump will be inspected quarterly for flow. Additionally, the cleanouts will be inspected quarterly for physical damage.

***Monitoring***

Groundwater elevations will be collected from selected monitoring wells on Detrex property and the RMI Property to the north located upgradient and downgradient of the barrier wall. Groundwater elevations and DNAPL thickness (if any) will be measured on a quarterly basis. Groundwater samples will collected from selected monitoring wells located upgradient and downgradient of the slurry wall on a semi-annual basis for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) (Methods 8260 and 8270). After five years of sampling, a review will be made of the results and the sampling program may be modified if results appear to be stable.

### 5.1.2 Recovery System Monitoring

***System Inspections***

The DNAPL system will be operated during working hours. Flow totalizer and DNAPL volumes will be estimated and recorded daily and documented by Detrex personnel. System maintenance personnel will prepare maintenance and inspection reports for the DNAPL Recovery System. These reports will be archived in the project file and stored at the Detrex central file location for no less than five years.

***Groundwater Monitoring***

Groundwater elevations and DNAPL thickness will be measured from all from the monitoring wells located within the estimated aerial extent of the DNAPL plume on a quarterly basis.

Quarterly status reports will be prepared by Detrex and submitted to USEPA. Detrex will retain these records for no less than five years.

***Vapor Emissions Sampling***

Vapor emissions are continuously monitored via an in line indicator. All vapors are exhausted through at least two carbon canisters that are installed in series. When the first in line indicator fails, a new container is installed as the second container in the series and the previous second container becomes the first container. This process is repeated every time the in line indicator turns color showing the activated carbon is spent.

### 5.1.3 Quality Assurance/Quality Control Procedures

Samples for QA/QC will include the following:

- One duplicate sample will be submitted for analysis with each round of semi-annual groundwater samples. One laboratory-prepared trip blank and one laboratory-prepared temperature blank will accompany each sample shipping container.
- All samples will be shipped or delivered to an approved laboratory using appropriate chain-of-custody protocol to assure proper handling of samples.
- Following receipt of data, the information will be reviewed to verify that samples were analyzed within the required holding times, the analyses met the required detection limits, and all spikes and duplicate samples were within acceptable ranges.

## 6.1 Potential Safety Issues

A detailed site specific health & safety plan has been prepared for the Operation and Maintenance activities. All O & M personnel are required to read the health and safety plan prior to mobilizing to the site. Potential safety issues associated with operation and maintenance of the DNAPL recovery system include, but are not limited to, the following:

- Chemical hazards (inhalation, ingestion, contact);
- Use of hazardous substances (Iron Out® or other);
- Lock out/tag out;
- Heat and cold stress;
- Noise exposure hazards;
- Hand safety when using hand tools; and,
- Back safety during lifting.

## 6.2 Safety Procedures

Operation and maintenance of the system includes, but is not limited to, the following mandatory safety procedures:

- All work must be conducted in accordance with the site-specific Health and Safety Plan for Operations and Maintenance procedures.
- Each operation and maintenance task must be performed by personnel qualified to perform the specific task.

## 6.3 Necessary Equipment

Appropriate safety and protective equipment must be worn to perform specific tasks in accordance with the site specific Health and Safety Plan for Operations and Maintenance procedures.

## 7.1 Operating Logs

A record of operational inspection and maintenance activities shall be maintained for no less than five years. This log should include the name of the recorder, the date, flow totalizer readings, a record of the hour-meter readings for the blower and transfer pump, information on the operational status of system components, maintenance needs, and other information. A sample log is presented in Appendix G.

## 7.2 Laboratory Records

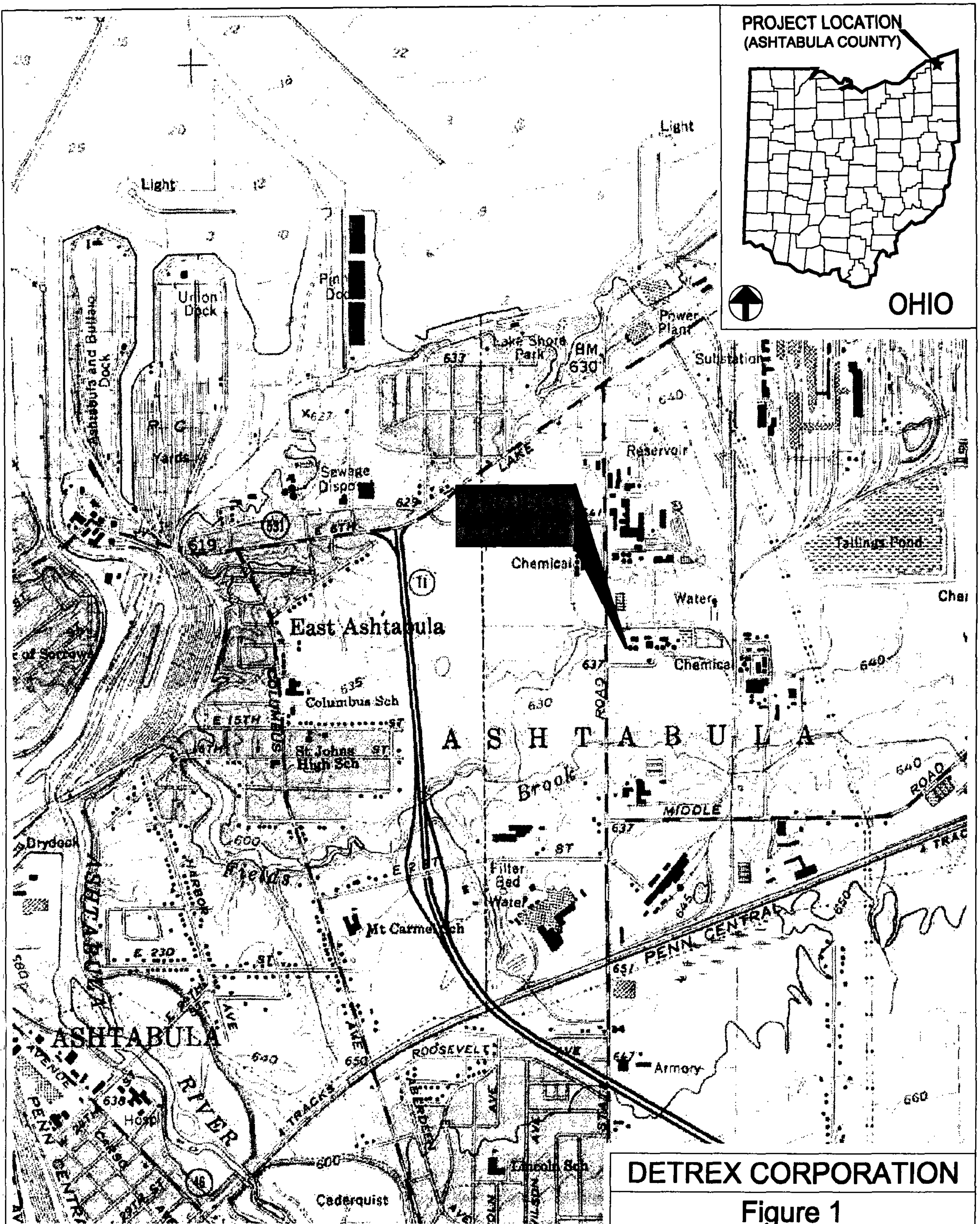
Laboratory records of system effluent sampling and groundwater monitoring shall be maintained in a Detrex-designated, central location for no less than five years.

## 7.3 Reporting

### 7.3.1 Reporting to USEPA

Quarterly status reports will be submitted to the USEPA throughout the operational life of the remedial system. These data will include a summary of water level measurements, system O&M activities and performance, updates on system modifications, analytical results, DNAPL recovery volumes, and other pertinent data.

## Figures

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DETREX CORPORATION

Figure 1
Site Location Map

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# Figures

# Appendices

# Appendix A
# Boring Logs

# Appendix B
# Air Diaphragm Pumps and Controller Information

# Appendix C
# Soil Vapor Extraction System Information

# Appendix D
# Settling Tank Information

# Appendix E
# Flow Totalizer Information

# Appendix F
# Information on Miscellaneous System Components

# Appendix G
# Sample Operation & Maintenance Log Form

# Appendix H
# Schedule